Efficacy of splint treatment or splint plus gabapentin treatment in idiopathic carpal tunnel syndrome

Splint or splint plus gabapentin in carpal tunnel syndrome

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Abstract

Aim: The aim of the present study was to evaluate the efficiency of gabapentin treatment combined with splint application in idiopathic carpal tunnel syndrome (CTS) and to determine clinically and electroneurophysiologically if the combined treatment is superior to splint application alone. Material and Method: A total of 30 patients with a clinical and electroneurophysiological diagnosis of CTS were recruited to the study and randomized into two groups to receive combined treatment consisting of 1800 mg/day gabapentin and splint application or to use splint alone. Clinical assessments were performed at baseline, at month 1 and month 6. Patients were assessed by Visual Analogue Scale (VAS), Boston Carpal Tunnel Questionnaire (BCTQ), grip strength and electroneurophysiological studies; the treatment satisfaction was evaluated by a Lickert scale. Results: VAS-pain, -paresthesia scores were improved in both groups with no statistical difference between the groups. Grip strength and functional assessments were improved significantly only in the splint group. In electroneurophysiological studies, distal motor latency in the combined treatment group, sensory latency in splint group and sensory conduction velocity in both groups were improved significantly. Intergroup comparisons revealed significant improvement in combined treatment group only for sensory conduction velocity. Discussion: In conclusion, our study suggests that combination of splint and gabapentin is not superior to the splint alone in the treatment of CTS, except for median nerve sensory conduction velocity.

Keywords

Carpal Tunnel Syndrome; Gabapentin; Splint

DOI: 10.4328/JCAM.5483 Received: 07.11.2017 Accepted: 05.01.2018 Published Online: 06.01.2018 Printed: 01.03.2018 J Clin Anal Med 2018;9(2): 116-20
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Introduction

Carpal tunnel syndrome (CTS) is the most common form of entrapment mononeuropathies which results from the compression of median nerve at the level of the wrist. It is commonly observed in clinical practice with a general prevalence of about %1 [1]. Although the etiology of CTS is unknown, it affects females more than males, and it occurs in middle-aged individuals and workers with tasks requiring repetitive hand movements [2].

The most common symptom is burning pain associated with tingling and numbness in median nerve distribution distally to the wrist. The symptoms are at their worst at night and often wake the patient. The other common symptoms of CTS include numbness or tingling in the first three digit, pain in the hand, forearm, elbow, shoulder, and a weakness of thumb abduction [3]. The diagnosis of CTS is usually based on symptoms and confirmed by neurophysiologic evaluation.

Wrist splinting, activity modification, non-steroidal anti-inflammatory drugs, exercises, physical therapy modalities, local steroid injections and surgical treatments are used to relieve the pressure on the median nerve [4]. Among the conservative treatments of CTS, splinting is the most popular method [5]. Immobilization of the wrist in a neutral position with a splint maximizes the carpal tunnel volume and minimizes the pressure on the median nerve [6]. Several studies showed that splinting therapy reduces the pressure of the carpal tunnel [7,8]. Kruger et al. reported that splinting the wrist in the neutral position improved symptoms and electrophysiological parameters in CTS [7]. Similarly, Burke et al. reported that the pressure of carpal tunnel was found lower in the neutral position and clinical improvement was found better [8].

The antiepileptic drugs such as pregabalin and gabapentin have been used for the treatment of neuropathic pain [9-11]. Gabapentin has shown to have a beneficial role in central and peripheric neuropathic pain, in placebo-controlled, randomized, double-blind several studies [12,13]. However, the number of the studies which shows beneficial effects of gabapentin on CTS is limited.

In the present study, we aimed to investigate the effects of combined gabapentin and splint therapy in idiopathic CTS by using electrophysiological and clinical parameters. We also aimed to determine if the combined treatment is superior to splint application alone.

Material and Method

This study was carried out at the outpatient clinic of the Eskisehir Osmangazi University Faculty of Medicine, Department of Physical Medicine, and Rehabilitation. A total 60 hands of 31 patients (27 female, 4 male) who had symptoms longer than 6 months with clinical and electrophysiological evidence of mild or moderate idiopathic CTS were included in the study.

The exclusion criteria included the following: a history of secondary entrapment neuropathies, cervical radiculopathy or systemic diseases that are associated with increased CTS risk in addition to those who had undergone surgery for the syndrome, history of steroid injections into the carpal tunnel and physical therapy within the last 3 months, pregnancy, and lactation. Additionally, patients with either thenar atrophy or spontaneous activity (fibrillation potentials and positive sharp waves) as determined by an electrophysiological examination of the abductor pollicis brevis (APB) muscle were excluded from the study.

The patients were briefed about the study, and written consent was obtained from all patients.

Study design

This study was designed as a prospective, randomized, single-blind clinical study with a 6-months follow up. Clinical assessments were performed at baseline, at month 1 and month 6 by the same physician who was blind to the treatment they would receive. Following baseline assessments, patients who fulfilled the entry criteria were admitted to this study and 31 patients (60 hands) were randomly assigned to two groups by a secure system of numbered 1-2 opaque closed envelopes.

Treatment protocol

Group 1 (16 patients, 30 hands) received 1800mg/day of gabapentin and splinting therapy in the neutral position for 6 months. 1800mg/day of gabapentin is divided into three doses per day. Group 2 (15 patients, 30 hands) received only splinting therapy in the neutral position for 6 months. Custom-made neutral volar splints were given to all patients who were included in the study. They were instructed to wear the splints at night and as much as possible during the day for a total of the six months.

Clinical assessments

Severity of pain and paresthesia, grip strength, Boston carpal tunnel questionnaire (BCTQ) were used for the clinical follow-up and evaluation of the patients. The severity of pain and paresthesia was assessed using visual analog scale (VAS) consisting of 10 cm horizontal lines with anchor points of 0 (no pain) and 10(maximum pain). Grip strength was determined by using a baseline hydraulic hand dynamometer. The patient sat on a chair in a comfortable position. The application was explained to the patient. Each measurement was carried out 3 times while taking a resting period of 2 min between each measurement. The mean score of three measurements was calculated and recorded in pounds.

Boston carpal tunnel questionnaire, a self-administered disease-specific outcome instrument, was used to assess the severity of symptoms and the functional status. The Symptom Severity Scale has 11 items in relation to pain, including nocturnal symptoms, numbness, tingling, and weakness. The questionnaire consists of two multi-item scales: The Symptom Severity Scale (SSS) and the Functional Status Scale (FSS). The FSS encompasses 8 items (difficulty in writing, buttoning clothes, opening jars, holding a book, gripping a telephone handle, performing household chores, carrying grocery bags, bathing, and dressing). Each item in these scales has five ordinal response categories, ranging from 1 (no symptoms or no difficulty) to 5 (severe symptoms) [14]. Previously validated Turkish version of the questionnaire was used to evaluate the treatment response. [15].

Nerve conduction studies

Median nerve conduction studies were performed at baseline and at the end of the treatment. Using standard techniques,

all of the electrodiagnostic tests were performed by the same neurophysiologist using a Neuropack M1 (Nihon Kohden, Tokyo, Japan) electroneuromyography machine**.** The hands of each patient were warmed prior to testing by seating them for 15 minutes in an examining room at a temperature of 22-24°C.

Median motor nerve conduction was recorded over the center of the abductor pollicis brevis muscle on the thenar eminence that was stimulated supramaximally at two different points; the first one is distally, 2cm proximal to the volar surface of the wrist, between flexor carpi radialis and Palmaris longus tendons, at least 6 cm away from the active electrode and, the second one proximally, on the anterior surface of the upper arm between the biceps tendon and the medial epicondyle, over brachial artery. Compound muscle action potential amplitudes, distal latencies, motor conduction velocities were calculated.

Sensorial nerve conduction was recorded over the wrist which was stimulated from two different points; at the palm and at the proximal and distal interphalangeal joints of the index. Amplitudes for each sensorial stimulation and sensorial nerve conduction velocities were calculated.

All abnormal distal latencies and velocities on the median motor and sensorial nerve, without any concomitant conduction abnormality on the other examined upper extremity nerves, confirmes the clinical diagnosis of CTS.

The satisfaction of the patients was evaluated with Likert Scale, graded on a scale of 1 to 5. (1: low, 5: high) at the end of 1 month and 6 months.

Statistical analyses were performed using SPSS 22.0 for Windows. A p-value less than 0.05 ($p<0.05$) was considered significant. The descriptive data were represented with n (sample size), mean and standard deviation for continuous variables and, n (sample size), median and 25th and 75th percentiles for categorical variables. Chi-square analyses were used for categorical variables. None normally distributed, independent data was analyzed with Mann Whitney U and Wilcoxon t-tests.

Results

Based on the selection criteria, 31 patients (60 hands) with CTS (4 male, 27 female) were included in the trial, 30 of them (58 hands) completed the study period. There were no significant differences in the baseline characteristic of 30 patients randomized in the study (Table 1).

Statistically significant improvements were observed in VAS-pain, VAS-paresthesia, SSS and grip strength in both groups at the end of treatment ($p<0.05$). However only in group 2, a statistically significant improvement was observed in FSS scores ($p<0.05$).

Table 1.Baseline characteristic of patients

	Group 1	Group 2	P
	n=28	n=30	
Age (years)	47 (41-53,5)	49 (37-56)	p>0,05
Gender (Female/male)	26/2	24/6	
Duration of symptoms (month)	21 (6-27)	24 (24-24)	p>0,05
Dominant extremity (right/left)	28/0	24/6	
Affected extremity (right/left)	15/13	15/15	

Comparisons between the two groups revealed a significant difference in grip strength (first month: $p<0.05$, sixth month: $p<0.01$) and functional status scale (first-month $p<0.01$, sixth month: $p<0.05$) in favor of the group 2 as compared with group 1. Patient satisfaction showed a significant improvement in both groups ($p<0.05$) (Table 2).

Table 2.Comparison of the clinical parameters at baseline, at first month and at sixth months

	Group 1 Median (min-max) (n=28)	Group 2 Median (min-max) (n=30)	P value
VAS-pain			
Baseline	5 (5-7)	5 (4-6)	p>0.05
First month	3 (2-5,5)*	4 (2-5)*	p>0.05
Sixth month	3 (0-4,5)*	2 (0-5)*	p>0.05
VAS-paresthesia			
Baseline	6,5 (5-8)	5,5 (3-7)	p>0.05
First month	4 (3-7)*	4 (2-5)*	p>0.05
Sixth month	4 (2-6)*†	3 (1-5)*	p>0.05
Grip Strength			
Baseline	40 (31,25-53,75)	50 (40-55)	p>0.05
First month	42,5 (36,25-53,75)*	55 (45-60)*	p<0.05
Sixth month	40 (35-50)*	55 (45-65)*	p<0.01
FSS			
Baseline	21,5 (14,5-26,5)	17 (12-21)	p>0.05
First month	20,5 (12,5-24)	12,5 (10-18)*	p<0.01
Sixth month	17,5 (12-21,5)	13 (10-16)*	p<0.05
SSS			
Baseline	28 (23,5-35,5)	27 (21-31)	p>0.05
First month	23,5 (16-30,5)*	21 (14-23)*	p>0.05
Sixth month	24 (17-27)*	18 (15-24)*	p>0.05
Patient satisfaction			
First	2 (1-3)	2,5 (2-3)*	p>0.05
Sixth month	2 (1,75-2,25)	2 (2-3)*	p>0.05

SSS :Symptom Severity Scale
FSS : Functional Status Scale
*: significantly different from baseline ($p<0.05$)
†:significantly different from first month ($p<0.05$)

Compared to baseline, significant improvements were observed in electrophysiological parameters in both groups. As shown in the table, distal motor latency ($p<0.01$) and distal sensory latency (palm to wrist: $p<0.001$ digit II to wrist: $p<0.01$) showed a significant improvement in patients in group 1. Compound muscle action potential (palm to wrist: $p<0.05$) and distal sensory latency (palm to wrist: $p<0.01$, digit II to wrist: $p<0.05$) showed a significant improvement in group 2. Comparisons between the groups revealed a significant difference in distal sensory latency ($p<0.05$) in favor of the group-1 as compared with group 2 (Table 3).

Discussion

In this study, we aimed to evaluate the efficiency of gabapentin treatment combined with splint application in idiopathic CTS, one of the most common painful conditions in rheumatology practice and to determine clinically and electroneurophysiologically whether the combined treatment is superior to splint application alone or not. The results obtained showed

Table 3. Comparison of electrophysiological parameters at baseline and at sixth months.

	Group 1 Median (min-max) (n=28)	Group 2 Median (min-max) (n=30)	P value
Distal motor latency			
Baseline	3,72 (3,57-4,50)	3,64 (3,42-4,27)	p>0.05
Sixth month	3,43 (2,64-3,87)	3,70 (3,20-3,94)	p>0.05
P value	p<0.01	p>0.05	
CMAP (wrist)			
Baseline	6,95 (2,69-9,47)	5,00 (4,63-5,91)	p>0.05
Sixth month	6,88 (3,52-9,35)	5,42 (4,28-8,01)	p>0.05
P value	p>0.05	p>0.05	
CMAP (elbow)			
Baseline	5,35 (1,43-9,27)	4,61 (3,70-5,60)	p>0.05
Sixth month	6,86 (3,42-9,39)	4,73 (3,36-7,02)	p>0.05
P value	p>0.05	p>0.05	
Motor nerve conduction velocity			
Baseline	59,10 (54,90-63,77)	59,70 (54,70-63,20)	p>0.05
Sixth month	57,75 (50,85-61,92)	56,10 (53,30-59,70)	p>0.05
P value	p>0.05	p>0.05	
CNAP (digit II to wrist)			
Baseline	10,60 (5,37-13,02)	5,80 (3,00-11,15)	p>0.05
Sixth month	12,05 (7,47-13,77)	10,40 (6,50-17,60)	p>0.05
P value	p>0.05	p>0.05	
CNAP (palm to wrist)			
Baseline	10,85 (2,27-47,25)	9,20 (4,55-19,50)	p>0.05
Sixth month	10,10 (6,22-12,57)	13,90 (7,75-31,90)	p>0.05
P value	p>0.05	p<0.05	
SDL (digit II to wrist)			
Baseline	34,15 (32,85-37,55)	35,30 (29,65-38,00)	p>0.05
Sixth month	41,05 (34,90-45,65)	37,30 (32,90-40,65)	p>0.05
P value	p<0.01	p<0.05	
SDL (palm to wrist)			
Baseline	28,50 (26,02-31,35)	25,4 (23,25-31,65)	p>0.05
Sixth month	32,65 (27,97-42,90)	29,4 (25,60-34,25)	p<0.05
P value	p<0.001	p<0.01	

CMAP: compound muscle action potential
SDL: Sensory distal latency
CNAP: compound nerve action potential

that combination of splint and gabapentin is not superior to the splint alone in the treatment of CTS.

Gabapentin is an effective drug for the treatment of neuropathic pain and has been reported to be effective in various diseases including trigeminal neuralgia, postherpetic neuralgias, and diabetic neuropathy [11,12,16]. The recommended and tolerable dosage of gabapentin in the literature is reported between 900 and 3600 mg per day [17]. In our study, we used 1800mg/day gabapentin dosage with splinting therapy. There are a few studies evaluating the efficacy of gabapentin in CTS [17-21]. The results of these studies are conflicting. In a prospective clinical trial with a three months follow-up period by Duman et al., it is reported that a significant reduction observed in symptoms in 21 patients with CTS, using 600-900mg/day gabapentin [18]. Also in another trial, Erdemoglu reported a reduction in SSS and FSS in 41 patients with CTS, using 1800mg/day gabapentin [20]. However, these two studies were single group studies with no control group and randomization. In a randomized, controlled trial with two months follow-up, Eftekharsadat et al. reported that in comparison to splinting therapy, the combination of splint and gabapentin with a low dose (100-300mg/day) decreased VAS, SSS, FSS significantly [17]. In all these trials gabapentin was found effective to reduce the symptoms in CTS. In contrast, in another randomized, double-blinded, placebo controlled trial by Hui et al., the mean reduction in symptom severity of patients using gabapentin (300-900mg/day) was not found significant when compared with placebo at eighth week [21]. This trial showed that gabapentin has no superiority over placebo. In our trial, a reduction was observed in symptom severity in both groups; however, comparisons between the groups showed that combination of gabapentin and splint therapy is not superior to splint therapy in reducing symptoms.

The neutral position of the wrist, reduce the pressure on the median nerve in the carpal tunnel and splints are designed to hold the wrist in the neutral position [8,22]. The efficacy of wrist splinting has been variably demonstrated in several studies [7, 23-25]. In a randomized case-control trial by Premoselli et al., it is reported that splinting therapy improved symptoms and electrophysiological parameters in CTS patients [23]. Another randomized study with 6 weeks follow-up, also showed that all day splinting was effective on symptoms [24]. Similar to our study, Kruger et al. reported significant improvement in signs and symptoms of CTS and distal sensory latency in 67% of 105 patients with CTS and also reported that it is possible to get a positive result if the treatment starts within the first three months of the disease [7]. Also in a prospective, randomized, and blinded trial with 1-year follow-up, it is reported that splinting therapy improved symptoms, motor, and sensorial conduction velocities when the splints were worn almost every night [25].

Usually, the diagnosis of carpal tunnel syndrome is made primarily by clinical examination and the patient's history of symptoms, though it is necessary to confirm the diagnosis with the use of electrodiagnostic nerve testing. In our study, electroneurophysiological studies showed improvement in both groups; however intergroup comparisons revealed a significant improvement in combined treatment group only for the sensory conduction velocity. Sensory component of the median nerve is sensitive to pressure more than motor component, and electroneurophysiological changes effect sensory component earlier. The motor component is usually effected in the progressive period of CTS [26, 27].

The results of the prospective study by Taverner in which the patients were treated with gabapentin (1800mg/day), showed that there were no significant changes in the electroneurophysiological parameters at the end of 6 months [19]. The results of this study are conflicting with our results. However, this study was a single group study without control group and randomization. Because of this reason, the findings of our studies must be interpreted against this background. In contrast to our study, Eftekharsadat et al. did not find any statistically significant change in the electroneurophysiological parameters in which the patients were treated with low dose gabapentin

(100-300mg/day). In our study, we used a dosage of 1800 mg, and we think that the difference in our results mainly depends on the gabapentin dosage. The recommended and tolerable dosage of gabapentin in the literature is reported between 900 and 3600 mg per day, and such a low dose of gabapentin may not play a role in the electroneurophysiological changes in CTS [17]. In our study, we could not demonstrate any beneficial effect of both treatment protocols on motor conduction. This result may be explained by our patients were not at early stages of CTS, as Kruger et al. emphasized [7].

Gabapentin may cause some adverse effects like dizziness, drowsiness. In our study, adverse effects were found in some patients, but it was well tolerated, and it was found that sleeping patterns of patients improved.

The main limitation of this study was the relatively small sample size. Depending on the inclusion criteria, only the patients who had CTS symptoms longer than 6 months were admitted, and this factor limited the number of patients included in the study. On the other hand, we think that long-term evaluation of both clinical and electroneurophysiological parameters strengths our study,

In conclusion, the results of this study indicate that splinting is effective on symptoms and electroneurophysiological parameters in CTS and gabapentin combined therapy is not superior to the splinting alone, except for sensory conduction velocity of the median nerve and we believe that further well-designed trials are needed.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding

None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Aroori S, Spence RAJ. Carpal tunnel syndrome. Ulster Med J. 2008; 77: 6–17.
2. Armstrong T, Dale AM, Franzblau A, Evanoff BA. Risk factors for carpal tunnel syndrome and median neuropathy in a working population. J Occup Environ Med. 2008; 50: 1355–64.
3. Padua L, Coraci D, Erra C, Pazzaglia C, Paolasso I, Loreti C, et al. Carpal tunnel syndrome: clinical features, diagnosis, and management. Lancet Neurol. 2016; 15(12): 1273-84.
4. Wipperman J, Goerl K. Carpal Tunnel Syndrome: Diagnosis and Management. Am Fam Physician. 2016; 94(12): 993-9.
5. Akalin E, El Ö, Peker Ö, Şenocak Ö, Tamirci Ş, Gülbahar S, et al. Treatment of carpal tunnel syndrome with nerve and tendon gliding exercises. Am J Phy Med Rehabil. 2002; 81: 108–13.
6. Page MJ, Massy-Westropp N, O'Connor D, Pitt V. Splinting for carpal tunnel syndrome. Cochrane Database Syst Rev. 2012; 11(7): CD010003.
7. Kruger VL, Kraft GH, Deitz JC, Ameis A, Polissar L. Carpal tunnel syndrome: objective measures and splint use. Arch Phys Med Rehabil. 1991; 72(7): 517-20.
8. Burke DT, Burke MM, Stewart GW, Cambre A. Splinting for carpal tunnel syndrome: in search of the optimal angle. Arch Phys Med Rehbil. 1994; 75: 1241–43.
9. Finnerup NB, Attal N, Haroutounian S, McNicol E, Baron R, Dworkin RH, et al. Pharmacotherapy for neuropathic pain in adults: a systematic review and meta-analysis. Lancet Neurol. 2015; 14(2): 162-73.
10. Xu L, Zhang Y, Huang Y. Advances in the Treatment of Neuropathic Pain. Adv Exp Med Biol. 2016; 904: 117-29.
11. Schreiber AK, Nones CF, Reis RC, Chichorro JG, Cunha JM. Diabetic neuropathic pain: Physiopathology and treatment. World J Diabetes. 2015; 6(3): 432-44.
12. Rauck R, Makumi CW, Schwartz S, Graff O, Meno-Tetang G, Bell CF, et al. A randomized, controlled trial of gabapentin enacarbil in subjects with neuropathic pain associated with diabetic peripheral neuropathy. Pain Pract. 2013; 13(6): 485-96.
13. Zhang L, Rainka M, Freeman R, Harden RN, Bell CF, Chen C, et al. A randomized, double-blind, placebo-controlled trial to assess the efficacy and safety of gabapentin enacarbil in subjects with neuropathic pain associated with postherpetic neuralgia (PXN110748). J Pain. 2013; 14(6): 590-603.
14. Levine DW, Simmons BP, Koris MJ, Daltroy LH, Hohl GG, Fossel AH, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. J Bone Joint Surg Am. 1993; 75(11): 1585-92.
15. Sezgin M, Incel NA, Serhan S, Camdeviren H, As I, Erdogan C. Assessment of symptom severity and functional status in patients with carpal tunnel syndrome: reliability and functionality of the Turkish version of the Boston Questionnaire. DisabilRehabil. 2006; 28: 1281–85.
16. Leon JB, Picardo A, Garrido A, Cuberes R. Gabapentin therapy for genitofemoral and ilioinguinal neuralgia. J Neurol. 2001; 248: 907-8.
17. Eftekharsadat B, Babaei-Ghazani A, Habibzadeh A. The Efficacy of 100 and 300 mg Gabapentin in the Treatment of Carpal Tunnel Syndrome. Iran J Pharm Res. 2015; 14(4): 1275-80.
18. Duman I, Aydemir K, Ozgul A, Kalyon TA. Assesment of the efficacy of gabapentin in carpal tunnel syndrome. J Clin Rheumatol. 2008; 14: 175-7.
19. Taverner D, Lisbona MP, Segalés N, Docampo E, Calvet S, Benito P. Efficacy of gabapentin in the treatment of carpal tunnel syndrome (abstract). Med Clin (Barc). 2008; 130: 371-3.
20. Erdemoglu KA, Varlibas A. The efficacy and safety of gabapentin in carpal tunnel patients: Open-label trial. Neurology India. 2009; 57: 300-3.
21. Hui AC, Wong SM, Leung HW, Man BL, Yu E, Wong LK. Gabapentin for the treatment of carpal tunnel syndrome: a randomized controlled trial. Eur J Neurol. 2011; 18(5): 726-30.
22. Yağcı İ, Uçan H, Yılmaz L, Yağmurlu F, Keskin D, Bodur H. Karpal tünel sendromu tedavisinde splint, splint ilelokal steroid enjeksiyonu ve cerrahinin karşılaştırılması. Türk Fiz Tıp Rehab Derg. 2006; 52 (2): 55-60.
23. Premoselli S, Sioli P, Grossi A, Cerri C. Neutral wrist splinting in carpal tunnel syndrome: a 3 and 6 month clinical and neurophysiologic followup evaluation of night only Splint therapy. EuraMedicophys. 2006; 42(2): 121-6.
24. Walker WC, Metzler M, Cifu DX, Swartz Z. Neutral wrist splinting in carpal tunnel syndrome: a comparison of night-only versus full-time wear instructions. Arch Phys Med Rehabil. 2000; 81(4): 424-9.
25. Sevim S, Dogu O, Camdeviren H, Kaleagasi H, Aral M, Arslan E, et al. Long-term effectiveness of steroid injections and splinting in mild and moderate carpal tunnel syndrome. Neurol Sci. 2004; 25(2): 48-52.
26. Practice parameter for electrodiagnostic studies in carpal tunnel syndrome (summary statement). American Academy of Neurology, American Association of Electrodiagnostic Medicine, and American Academy of Physical Medicine and Rehabilitation. Neurology. 1993; 43(11): 2404-5.
27. Jablecki CK, Andary MT, So YT, Wilkins DE, Williams FH. Literature review of the usefulness of nerve conduction studies and electromyography for the evaluation of patients with carpal tunnel syndrome. AAEM Quality Assurance Committee. Muscle Nerve. 1993; 16(12): 1392-414.

How to cite this article:
Mehmetoglu O, Tascioglu F, Bakilan F, Armagan O. Efficacy of splint treatment or splint plus gabapentin treatment in idiopathic carpal tunnel syndrome. J Clin Anal Med 2018;9(2): 116-20.